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☐ 1. Document ID: US 20020180816 A1

L11: Entry 1 of 14

File: PGPB

Dec 5, 2002

DOCUMENT-IDENTIFIER: US 20020180816 A1

TITLE: Compensation method for overlapping print heads of an ink jet printer

Brief Description of Drawings Paragraph (5):

[0017] FIG. 4 is an illustration of the ink droplets deposited in a single-pass full color fill by the overlapping region of an ink jet printer having two print heads that are horizontally misaligned.

Brief Description of Drawings Paragraph (6):

[0018] FIG. 5 is an illustration of the ink droplets deposited in a single-pass full color fill by the overlapping region of an ink jet printer having two print heads that are vertically misaligned.

Brief Description of Drawings Paragraph (7):

[0019] FIG. 6 is an illustration of the ink droplets deposited in a single-pass full color fill by the overlapping region of an ink jet printer having two print heads that are horizontally and vertically misaligned.

Brief Description of Drawings Paragraph (9):

[0021] FIG. 8 is an illustration of the ink droplets deposited in a single-pass full color fill by the overlapping region of an ink jet printer having two print heads that are vertically misaligned utilizing dithering to improve the image quality.

Brief Description of Drawings Paragraph (10):

[0022] FIG. 9 is an illustration of the ink droplets deposited in a single-pass full color fill by the overlapping region of an ink jet printer having two print heads that are horizontally and vertically misaligned, and where dithering is used to improve the image quality.

Brief Description of Drawings Paragraph (11):

[0023] FIG. 10 is an illustration of the ink droplets deposited in a single-pass full color fill by the overlapping region of an ink jet printer employing an example of dithering and timing offset to correct horizontal and vertical misalignment.

Detail Description Paragraph (13):

[0035] FIG. 4 is an illustration of the ink droplets deposited in a single-pass full color fill by the overlapping region of an ink jet printer having two print heads that are horizontally misaligned. Again, in this figure, droplets deposited by the two print heads 56, 60 are distinguished among the two print heads by using X's for the droplets from the upper print head 56 and O's for the droplets from the lower print head 60. In this illustration indicating that the two print heads 56, 60 are horizontally misaligned, the droplets are disposed in a horizontally offset manner. There may be multiple reasons why horizontal misalignment may occur, which may include mechanical misalignment or an inappropriate firing timing. In any case, when a printer is in such a condition, a discontinuity in the image is created. In FIG. 4, the X's in the top five raster lines are not directly above the corresponding O's in the bottom five raster lines as they are supposed to be

Detail Description Paragraph (14):

[0036] FIG. 5 is an illustration of the ink droplets deposited in a single-pass full color fill by the overlapping region of an ink jet printer having two print heads

that are vertically misaligned. Again, the droplets deposited are distinguished among the two print heads 56, 60 by using X's for the droplets from one print head 56 and O's for the droplets from the other. In this illustration indicating that the two print heads 56, 60 are vertically misaligned, the droplets are disposed in a vertically offset manner. The vertical distance between the droplets from the top row of active nozzles of the bottom print head 56 and those droplets from the bottom active row of nozzles of the top print head 60 is not the same as the space between any two rows of droplets from the same print head 56, 60. This may be due to a mechanical problem in the positioning of the upper print head 56 with respect to the lower print head 60.

Detail Description Paragraph (15):

[0037] FIG. 6 is an illustration of the ink droplets deposited in a single-pass full color fill by the overlapping region of an ink jet printer having two print heads that are horizontally and vertically misaligned. In this illustration, the droplets are disposed in a manner indicating the worst case misalignment scenario; the two print heads 56, 60 are both vertically and horizontally misaligned. This misalignment may produce especially visible horizontal banding at the transition between the fifth and sixth raster lines.

Detail Description Paragraph (19):

[0041] FIG. 8 is an illustration of the ink droplets deposited in a single-pass full color fill by the overlapping region of an ink jet printer having two print heads that are vertically misaligned utilizing dithering to improve the image quality. The exemplary dithering pattern is utilized in this embodiment to obscure the vertical misalignment of the two print heads 56, 60 thereby improving the overall image quality. Again, the exemplary dithering pattern of FIG. 8 is used for illustrative purposes only and many different patterns may advantageously be utilized.

Detail Description Paragraph (21):

[0043] FIG. 10 is an illustration of the ink droplets deposited in a single-pass full color fill by the overlapping region of an ink jet printer employing an example of dithering and timing offset to correct horizontal and vertical misalignment. In FIG. 10, the use of dithering, described above and illustrated in FIG. 7 is further improved by including a timing correction, otherwise referred to as offset, to improve the horizontal misalignment. The image quality of FIG. 10 is a vast improvement over the worst case misalignment described above and illustrated in FIG. 7. To correct the misalignment problem, the timing of the firing of the droplets from each print head may be altered. For instance, it may be desirable to delay the firing of the nozzles of the leading print head 56 a short amount of time so that the droplets deposited from that print head 56, indicated by X's, correctly align with those of the trailing print head 60, indicated by O's. This correction may be referred to as offset and preferably takes place in the firing control circuitry of the printer. Advantageously, a printer may be designed wherein the firing of each print nozzle is controlled by an independent signal from the control circuitry so that each of them may be controlled separately. Such independent control would allow for offset correction to correct, theoretically, any horizontal misalignment of the multiple print heads.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KINC	Draw Desc	Image
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☐ 2. Document ID: US 20010050699 A1

L11: Entry 2 of 14

File: PGPB

Dec 13, 2001

DOCUMENT-IDENTIFIER: US 20010050699 A1

TITLE: Ink-jet print pass microstepping

Summary of Invention Paragraph (40):

[0036] In another basic aspect, the present invention provides an ink-jet hard copy

apparatus for printing on sheet media, the apparatus having a transport means for moving a sheet from an input along a media advance axis through a printing zone of the apparatus. The apparatus includes: a set of ink-jet pens, including at least two pens for each color ink mounted for scanning in a scan axis perpendicular to the media advance axis and including at least one column of nozzles parallel to the media advance axis for depositing ink drops as dots on a rectilinear matrix of target pixels on the sheet that is greater than nozzle packing density of the pens and can be defined by a digital print job data set and wherein the column of nozzles of each respective pen depositing ink drops of a like color ink are aligned for printing individual rows of the matrix wherein a printed swath has a greater dimension in the media advance axis than possible by a single pen of one color ink and wherein any misalignment of nozzles are determinable in a known manner; means for selecting printing resolution for the print job data set; means for setting a media advance distance at $d=(m * S)+S/n$, where d =microstep advance distance, less than or equal to the nozzle overlap distance between printheads, m =a value of zero or any integer, S =individual nozzle spacing, n =an integer greater than one; and means for printing the print job data set as a series of contiguous swaths of data wherein each swath is printed in multiple scans such that each colorant selectively simultaneous is addressing both odd and even print rows and wherein the pen-to-pen spacing is not required as an integer multiple of nozzle spacing distance, and the sheet is advances by the media advance distance between each scan such that printing resolution is greater than nozzle packing density.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	Claims	KWIC	Draw Desc	Image
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☐ 3. Document ID: US 6457806 B2

L11: Entry 3 of 14

File: USPT

Oct 1, 2002

DOCUMENT-IDENTIFIER: US 6457806 B2

TITLE: Ink-jet print pass microstepping

Brief Summary Text (25):

In another basic aspect, the present invention provides an ink-jet hard copy apparatus for printing on sheet media, the apparatus having a transport means for moving a sheet from an input along a media advance axis through a printing zone of the apparatus. The apparatus includes: a set of ink-jet pens, including at least two pens for each color ink mounted for scanning in a scan axis perpendicular to the media advance axis and including at least one column of nozzles parallel to the media advance axis for depositing ink drops as dots on a rectilinear matrix of target pixels on the sheet that is greater than nozzle packing density of the pens and can be defined by a digital print job data set and wherein the column of nozzles of each respective pen depositing ink drops of a like color ink are aligned for printing individual rows of the matrix wherein a printed swath has a greater dimension in the media advance axis than possible by a single pen of one color ink and wherein any misalignment of nozzles are determinable in a known manner; means for selecting printing resolution for the print job data set; means for setting a media advance distance at $d=(m*S)+S/n$, where d =microstep advance distance, less than or equal to the nozzle overlap distance between printheads, m =a value of zero or any integer, S =individual nozzle spacing, n =an integer greater than one; and means for printing the print job data set as a series of contiguous swaths of data wherein each swath is printed in multiple scans such that each colorant selectively simultaneous is addressing both odd and even print rows and wherein the pen-to-pen spacing is not required as an integer multiple of nozzle spacing distance, and the sheet is advances by the media advance distance between each scan such that printing resolution is greater than nozzle packing density.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments	KWIC	Draw Desc	Image
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☐ 4. Document ID: US 6339480 B1

L11: Entry 4 of 14

File: USPT

Jan 15, 2002

DOCUMENT-IDENTIFIER: US 6339480 B1

**** See image for Certificate of Correction ****

TITLE: Print driver for a color printer

Detailed Description Text (35):

Step S1003 applies output corrections to the CMYK multilevel data. Output corrections account for output characteristics of color printer 30, such as misalignment between respective print heads 31a and 31b, differences in print densities of those print heads, density blending between the overlap area of the print heads, and the like. Misalignments between print heads 31a and 31b are corrected as described in U.S. application Ser. No. 08/901,560, now U.S. Pat. No. 6,089,766, entitled "An Auto-Alignment System for A Printing Device", the contents of which are incorporated by reference as if set forth in full herein. Generally speaking, to correct for misalignments such as a vertical offset between the printing positions of heads 31a and 31b, an unshown optical sensor in printer 30 senses the actual printed output of predetermined print patterns in the overlap area of the two print heads, so as to drive a numerical value representation of the offset/misalignment between the two print heads. The print position of the CMYK multilevel data is then changed based on the numerical offset value to as to ensure that dots are printed by each head at positions that compensate for the misalignment.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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RMK	Draw Desc	Image
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☐ 5. Document ID: US 6336701 B1

L11: Entry 5 of 14

File: USPT

Jan 8, 2002

DOCUMENT-IDENTIFIER: US 6336701 B1

TITLE: Ink-jet print pass microstepping

Brief Summary Text (39):

In another basic aspect, the present invention provides an ink-jet hard copy apparatus for printing on sheet media, the apparatus having a transport means for moving a sheet from an input along a media advance axis through a printing zone of the apparatus. The apparatus includes: a set of ink-jet pens, including at least two pens for each color ink mounted for scanning in a scan axis perpendicular to the media advance axis and including at least one column of nozzles parallel to the media advance axis for depositing ink drops as dots on a rectilinear matrix of target pixels on the sheet that is greater than nozzle packing density of the pens and can be defined by a digital print job data set and wherein the column of nozzles of each respective pen depositing ink drops of a like color ink are aligned for printing individual rows of the matrix wherein a printed swath has a greater dimension in the media advance axis than possible by a single pen of one color ink and wherein any misalignment of nozzles are determinable in a known manner; means for selecting printing resolution for the print job data set; means for setting a media advance distance at $d=(m*S)+S/n$, where d =microstep advance distance, less than or equal to the nozzle overlap distance between printheads, m =a value of zero or any integer, S =individual nozzle spacing, n =an integer greater than one; and means for printing the print job data set as a series of contiguous swaths of data wherein each swath is printed in multiple scans such that each colorant selectively simultaneous is addressing both odd and even print rows and wherein the pen-to-pen spacing is not required as an integer multiple of nozzle spacing distance, and the

sheet is advances by the media advance distance between each scan such that printing resolution is greater than nozzle packing density.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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KMIC	Draw Desc	Image
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☐ 6. Document ID: US 5715331 A

L11: Entry 6 of 14

File: USPT

Feb 3, 1998

DOCUMENT-IDENTIFIER: US 5715331 A

TITLE: System for generation of a composite raster-vector image

Brief Summary Text (7):

Another process which uses composite images relates to color trapping for multicolor printing. In multicolor printing, colors can overlap between objects to prevent white gaps from appearing between colors if the printing plates are misaligned. The extension of the colors is called a trap. A system exists to automatically determine traps. The edges of a raster image are detected to determine boundaries. A vector image of the boundary is created in a color which merges the two adjacent colors. The image, including both the raster and vector parts, is used to create the different color plates. The data in the vector image provides the traps for overlapping colors. In such a system, only those object boundaries which violate specific rules with regard to registration of printing plates are affected. Other image details and objects are completely ignored. Furthermore, trap lines are created using a color that is common to both adjacent areas and are of a particularly fine weight to minimize visibility of the trap line while correcting for the potential misregistration problem.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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KMIC	Draw Desc	Image
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☐ 7. Document ID: US 5636573 A

L11: Entry 7 of 14

File: USPT

Jun 10, 1997

DOCUMENT-IDENTIFIER: US 5636573 A

TITLE: Cylinder positioning apparatus for offset presses and duplicators

Brief Summary Text (3):

In the printing of multicolor images, it is important that the registration of each color where it borders on another color be proper. Fine adjustments must be made to the printing presses to prevent misalignment of the colors, i.e., wherein the colors overlap each other or when there is a gap between the colors.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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KMIC	Draw Desc	Image
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☐ 8. Document ID: US 5546669 A

L11: Entry 8 of 14

File: USPT

Aug 20, 1996

DOCUMENT-IDENTIFIER: US 5546669 A

**** See image for Certificate of Correction ****

TITLE: Cylinder positioning apparatus for offset presses and duplications

Brief Summary Text (3):

In the printing of multicolor images, it is important that the registration of each color where it borders on another color be proper. Fine adjustments must be made to the printing presses to prevent misalignment of the colors, i.e., wherein the colors overlap each other or when there is a gap between the colors.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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KMIC	Draw Desc	Image
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☐ 9. Document ID: US 5543922 A

L11: Entry 9 of 14

File: USPT

Aug 6, 1996

DOCUMENT-IDENTIFIER: US 5543922 A

TITLE: Method and apparatus for on-press color measurement

Detailed Description Text (19):

There may also be other unknown printed matter, not shown, adjacent to the color bar in the web-movement direction WM up to the nominal position of the measurement patches. Thus, in addition to the overlap with other patches in the cross-web direction CW, there may be overlap with the unknown printed matter when measurement patches are misregistered in the web-movement direction WM. The nominal overlap of the patches in the cross-web direction CW causes the unprinted rectangle 204 to be easier to find under a variety of misregister conditions without significantly interfering with the central measurement area 202. Thus, the unique configuration of the color measurement patch 204 provides a readily identifiable feature, even under a variety of misregister conditions resulting in overlap with adjacent patches or unknown printed matter.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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KMIC	Draw Desc	Image
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☐ 10. Document ID: US 5490456 A

L11: Entry 10 of 14

File: USPT

Feb 13, 1996

DOCUMENT-IDENTIFIER: US 5490456 A

**** See image for Certificate of Correction ****

TITLE: Automated multiple station cap printing apparatus

Detailed Description Text (20):

A pair of threadably adjustable clamps 64 are conventionally provided to releasably fix print screen frame 60 within channels 59 in a well-known conventional manner. It is most desirable to also provide for fine adjustment of the position of screen holding frame 60 within channels 59 to better assure consistent registration location of the respective screens placed in each print head assembly spaced about the apparatus for multiple color printing. Such details are not included herein as they form no part of the present invention standing alone and it is well-known and understood by those skilled in the art that multiple color printing requires consistent, accurate placement of the screens in each respective print head to obtain the most desirable print image without overlapping or misalignment of the different colors used.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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KWIC	Draw Desc	Image
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☐ 11. Document ID: US 4833530 A

L11: Entry 11 of 14

File: USPT

May 23, 1989

DOCUMENT-IDENTIFIER: US 4833530 A

TITLE: Method and apparatus for printing ink by dissolving colorant with solvent deposited on a drum

Detailed Description Text (41):

While any one of the embodiments of FIGS. 1, 2, 3a, 3b and 4 are useful for recording multi-color or full-color images, the embodiments of FIGS. 3a and 3b are most preferred for color printing purposes since the misalignment of overlapping colors can be easily corrected optoelectronically. The following is a description of preferred embodiments useful for color printing purposes.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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KWIC	Draw Desc	Image
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☐ 12. Document ID: US 4731647 A

L11: Entry 12 of 14

File: USPT

Mar 15, 1988

DOCUMENT-IDENTIFIER: US 4731647 A

TITLE: Method and apparatus for printing ink by dissolving colorant with deposited solvent

Detailed Description Text (41):

While any one of the embodiments of FIGS. 1, 2, 3a, 3b and 4 are useful for recording multi-color or full-color images, the embodiments of FIGS. 3a and 3b are most preferred for color printing purposes since the misalignment of overlapping colors can be easily corrected optoelectronically. The following is a description of preferred embodiments useful for color printing purposes.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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KWIC	Draw Desc	Image
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☐ 13. Document ID: US 4712119 A

L11: Entry 13 of 14

File: USPT

Dec 8, 1987

DOCUMENT-IDENTIFIER: US 4712119 A

**** See image for Certificate of Correction ****

TITLE: Recording apparatus having plural adjustable recording heads

Detailed Description Text (16):

Thus, the positions of the nozzles 17 of the recording heads 5 relative to the platen roller 2 (or the sheet 1) can be precisely set. When overlapping printing as in color printing is performed, high quality recording free from color or dot misalignment can be performed.

Detailed Description Text (22):

Furthermore, since the head mounting base 6 is mounted on the carriage 4 and adjusted in the back-and-forth and parallel positions, the position of the base 6 relative to the platen roller 2 (including a parallel position) can be easily and precisely adjusted using a jig or a gauge block. Thus, the positions of nozzles of the heads 5 relative to the platen roller 2 can be easily and precisely set. In this manner, color misalignment in color printing by overlapping three primary colors can be prevented, and printing quality can be improved.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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RWMC	Draw Desc	Image
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☐ 14. Document ID: US 4583116 A

L11: Entry 14 of 14

File: USPT

Apr 15, 1986

DOCUMENT-IDENTIFIER: US 4583116 A

TITLE: Method and apparatus for eliminating defects in images in polychromatic printing due to faulty registration of superimposed printing of color separations

Brief Summary Text (7):

This printing method makes it simple to avoid flashes appearing due to registration, misalignment or misregistration, color margins or, respectively, undesired overlaps or non-uniform widths of lines in dark color boundaries because an enlargement or reduction of the surfaces of the individual color areas is done in that dark color areas are reduced at all locations by a prescribed width and light areas are enlarged in the direction of and over a dark color areas. The criteria for accomplishing this method is simple since only two colors of a precisely defined color composition meet in the image portions which are being considered and when selected color settings are used it is easy to distinguish or, respectively, determine between the two colors which forms the lighter or, respectively, the darker areas. Also, the overall number of colors employed is limited to a low number such that a clear statement concerning this criteria can be obtained at any time.

Full	Title	Citation	Front	Review	Classification	Date	Reference	Sequences	Attachments
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RWMC	Draw Desc	Image
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Print

Term	Documents
COLOR	667147
COLOUR	299312
COLOURS	39196
COLORS	179873
COLOUR	299312
COLOURS	39196
COLOR	667147
COLORS	179873
PRINT\$5	0
PRINT	502187
PRINTA	18
(PRINT\$5 WITH (COLOR OR COLOUR) WITH (MISREGIS\$5 OR MISALIGN\$5) WITH OVERLAP\$5).USPT,PGPB,JPAB,EPAB,DWPI,TDBD.	14

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